PROTECTION AGAINST LANDMINE EXPLOSION

This invention relates to a method of protecting a body or hull and any occupant of a land vehicle, such as an armoured vehicle, e.g. an armoured tank or car, against the effects of a landmine explosion, e.g. an anti-tank landmine explosion. It relates also to a land vehicle, and to a combination of a ground engaging element for a land vehicle and a shock wave guide member.

When a vehicle sets off a landmine, generally the landmine explodes underneath a ground engaging element such as a wheel or track of the vehicle because of the ground pressure created by said ground engaging element on the landmine.

Japanese Patent document having a publication number 2002090095, discloses an apparatus for removing a mine buried under the ground surface. The apparatus includes a composite rotor having a plurality of generally coaxial rollers loosely located with lost motion in a radial direction over a fixed axis shaft mounted on, so as spatially to lead, a vehicle. The rollers can individually follow contours, hollows, humps, etc. to trigger landmines. Behind the rotor there is provided a protective plate screening the landmine blast and protecting the vehicle and an occupant.

Japanese Patent document having a publication number 2002340499, discloses a rotor including a plurality of blades. The rotor is rotated to cause the blades to cut into a ground surface to destroy mines. A curved safety cover is provided over the rotor to protect the vehicle and a driver from sand, mud and landmine fragments. A low level grader-like blade deflects sand, mud and mine fragments laterally to provide a smooth running surface for the

vehicle. It is notable that the vehicle is not intended to trigger landmines to explode, but to destroy landmines before explosion. The inventor thus did not anticipate landmine explosions and resulting shock waves.

United States Patent 5442990 discloses a scarifying drum leading a track vehicle to explode landmines. A flap is provided over the drum to act as a shield.

In accordance with a first aspect of the invention, there is provided a method of protecting a body or hull and any occupant of a land vehicle movable along a substrate on ground engaging elements against the effects of a landmine explosion, including conducting shock waves generated by the landmine explosion laterally outwardly by means of a shock wave guide member of a material having a relatively high acoustic speed and located proximate a ground engaging element of the vehicle.

For purposes of this specification, terms denoting direction, such as fore, rear, lateral, and the like should be interpreted with reference to a normal direction of forward travel of a land vehicle. The term "laterally outward" means "sideways away from (the land vehicle)".

By "relatively high" acoustic speed is meant an acoustic speed higher than the acoustic speed of the metal used in components of the land

CLAIMS:

1. A method of protecting a body or hull and any occupant of a land vehicle movable along a substrate on ground engaging elements against the effects of a landmine explosion, including conducting shock waves generated by the landmine explosion laterally outwardly by means of a shock wave guide member of a material having a relatively high acoustic speed and located proximate a ground engaging element of the vehicle.

2. A method as claimed in Claim 1 in which the material of each shock wave guide member is selected from materials including glass, a suitable ceramic such as an alumina, or the like, which have an acoustic speed of higher than about 6000 m/sec.

3. A method as claimed in Claim 1 or Claim 2 in which the vehicle is a track vehicle, the ground engaging elements being in the form of tracks, the guide members being located in at least one of a well of a bogey wheel and immediately above a bottom run of a track intermediate bogey wheels.

4. A method as claimed in Claim 1 or Claim 2 in which the vehicle is a wheeled vehicle, the ground engaging elements being in the form of wheels, the guide member being located in a well of the wheel.

5. A land vehicle movable along a substrate on ground engaging elements, which land vehicle is adapted or converted to protect its body or hull and any occupant against the effects of a landmine explosion, the land vehicle comprising a plurality of shock wave guide members proximate ground engaging elements of the land vehicle,
characterized in that the shock wave guide members are of a material having a relatively high acoustic speed higher than the acoustic speed of metal used in components of the land vehicle which components have an acoustic speed generally of about 5000 m/sec, the shock wave guide members being oriented to conduct shock waves laterally outwardly away from the body or hull.

6. A land vehicle as claimed in Claim 5, in which the material of each shock wave guide member is selected from materials, including glass, a suitable ceramic material such as an alumina, which materials have an acoustic speed of higher than about 6000 m/sec.

7. A land vehicle as claimed in Claim 5 or Claim 6 which is in the form of a track vehicle, the ground engaging elements being in the form of tracks, in which the guide members are positioned in wells of bogey wheels, as well as immediately above a bottom run of each track intermediate bogey wheels.

8. A land vehicle as claimed in Claim 7 in which the guide members proximate tracks intermediate bogey wheels have layers of low friction material on their surfaces interfacing with the tracks.

9. A land vehicle as claimed in Claim 5 or Claim 6 which is in the form of a wheeled vehicle, the ground engaging elements being in the form of wheels, in which the guide members are positioned annularly in wells of the wheels.

10. A land vehicle as claimed in claim 5 or Claim 6 which is in the form of a wheeled vehicle, the ground engaging elements being in the form of wheels, each wheel having a hollow tyre around a wheel rim, in which the guide members are positioned annularly in the hollows of the tyres.

11. A land vehicle as claimed in any one of Claim 5 to Claim 10 inclusive in which the guide members are of composite construction, each guide member comprising a plurality of oriented or directed laminates of a material having an acoustic speed of at least about 6000 m/sec.

12. A land vehicle as claimed in Claim 11 in which the laminates are sandwiched in-between layers of material having a relatively low acoustic speed, lower than about 1000 m/sec.

13. A land vehicle as claimed in Claim 11 or Claim 12 in which the laminates are oriented to extend obliquely laterally outwardly in use.

14. A land vehicle as claimed in Claim 11, or Claim 12 or Claim 13 in which said guide members have surfaces which are profiled snugly to be received with little clearance, or even slight touching, on surfaces of the ground engaging elements.

15. A ground engaging element for a land vehicle in combination with a shock wave guide member of a material having an acoustic speed of higher than about 6000 m/sec, the guide member being locatable proximate a ground engaging surface of the ground engaging element.

16. A combination as claimed in Claim 15, in which the ground engaging element is a track and bogey wheel arrangement for a track vehicle, the guide member being adapted for location in one of a well of a bogey wheel, and immediately above a lower run of the track intermediate bogey wheels.

17. A combination as claimed in Claim 15, in which the ground engaging element is a wheel for a wheeled vehicle, the guide member being adapted for location within a well of the wheel.

18. A combination as claimed in Claim 15, in which the ground engaging element is a wheel, having a hollow tyre, for a wheeled vehicle, the guide member being adapted for location within the hollow of the tyre.

19. A method as claimed in Claim 1, substantially as herein described and illustrated.

20. A land vehicle as claimed in Claim 5, substantially as herein described and illustrated.

21. A ground engaging element in combination with a shock wave guide member as claimed in Claim 15, substantially as herein described and illustrated.